SECOND QUARTER 2026 | VOLUME 33

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On the cover: Antonio Colao, a 2025 ITSA scholarship recipient, programs a FANUC robot equipped with an F4 plasma spray gun at the Center for Thermal Spray Research, Stony Brook University, Stony Brook, N.Y.

Published by the International Thermal Spray Association, a Standing Committee of the American Welding Society

Mission: To be the flagship thermal spray industry publication providing company, event, personnel, product, research, and membership news of interest to industrial leaders, engineers, researchers, scholars, policymakers, and the public thermal spray community.

SPRAYTIME® (ISSN 1532-9585 Print) (ISSN 2689-0518 Online) is a quarterly publication of the International Thermal Spray Association. Printed on recycled paper.

Article submissions (subject to acceptance and editing), advertising insertions, address correspondence, subscription requests, back issue copies, and changes of address should be sent to:

American Welding Society
Attn: *SPRAYTIME*
8669 NW 36 St., #130, Miami, FL 33166-6672
(800/305) 443-9353 | *spraytime.org*

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Ashley Hunsaker
Chair

Eleven years ago, when Jason Hunsaker asked me to start a thermal spray business with him, I never would have imagined that today I would be serving as chair of the International Thermal Spray Association (ITSA). This is truly an honor, and one that I do not take lightly.

I recognize that there are many qualified individuals who could serve in this role, but I will do my very best to lead with integrity, humility, and a willingness to learn. As I reflect on the ITSA Mission Statement (included below), I realize how deeply it aligns with my own goals and passion for this industry.

Over the past eleven years, I have seen firsthand how thermal spray technologies solve a myriad of challenges across countless industries. Beyond that, I've come to appreciate how those solutions ultimately improve everyday life for all of us as consumers. The impact of this industry reaches further than many people realize, and I am proud to be part of it.

I strongly believe that we are better together. We were never meant to navigate life or business alone. We need each other, and that spirit of collaboration is what I hope to cultivate during my time as chair. My goal is to work alongside all of you in the thermal spray industry so we can continue fulfilling the ITSA mission together.

I look forward to leading, learning, and growing alongside you.

Please join us in sunny San Diego, Calif., on November 8–11 for the ITSA Annual Business Meeting. I can't wait to meet you!

ITSA MISSION STATEMENT

The International Thermal Spray Association (ITSA), a standing committee of the American Welding Society, is a professional industrial organization dedicated to expanding the use of thermal spray technologies for the benefit of industry and society. ITSA invites all interested companies to talk with our officers and company representatives to better understand member benefits.

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ITSA SCHOLARSHIP OPPORTUNITIES

ITSA offers annual graduate scholarships. Since 1992, the ITSA scholarship program has contributed to the growth of the thermal spray community, especially in the development of new technologists and engineers. ITSA is very proud of this education partnership and encourages all eligible participants to apply. Visit *thermalspray.org* for criteria information and a printable application form.

ITSA *SPRAYTIME*

Since 1992, ITSA has been publishing *SPRAYTIME* for the thermal spray industry. The mission is to be the flagship thermal spray industry publication providing company, event, personnel, product, research, and membership news of interest to the thermal spray community.

JOIN ITSA

Membership is open to companies involved in all facets of the industry — equipment and materials suppliers, job shops, in-house facilities, educational institutions, industry consultants, and others.

Engage with dozens of like-minded industry professionals at the Annual ITSA Membership Meeting, where there is ample time for business and personal discussions. Learn about industry advancements through the one-day technical program, participate in the half-day business meeting, and connect with peers in a relaxed atmosphere complete with fun social events.

Build awareness of your company and its products and services through valuable promotional opportunities: a listing in *SPRAYTIME*, exposure on the ITSA website, and recognition at industry trade shows.

In addition, ITSA Membership comes with an AWS Supporting Company Membership and up to five AWS Individual Memberships to give to your best employees, colleagues, or customers. Visit *aws.org/membership/supportingcompany* for a complete listing of additional AWS benefits. For more information or a membership application, contact Adrian Bustillo at (786) 937-9595 or *abustillo@aws.org*.

For an ITSA Membership application, visit the membership section at *thermalspray.org*.

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canada.fabtechexpo.com

Cold Spray Action Team
June 9–11
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coldsprayteam.com

Coatings Science International Conference (CoSI 2026)
June 22–25
Noordwijk, The Netherlands
coatings-science.com

AMPP Central Conference
September 28–30
St. Paul, MN
ampp.org/events/central-conference

IMAT 2026
Sept. 28–Oct. 1
Quebec City, Canada
asminternational.org/imat

FABTECH
Oct. 21–23
Las Vegas, NV
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November 8–11
San Diego, CA
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Apply for a $2000 ITSA Scholarship

Applications for the International Thermal Spray Association's (ITSA's) Scholarship Program will be accepted until August 21. Up to three one-year scholarships worth $2000 each may be awarded. Since 1991, the ITSA Scholarship Program has contributed to the growth of the thermal spray community, especially the development of new technologists and engineers.

To be considered, applicants must meet all the following criteria:

- Be actively pursuing a postgraduate degree in thermal spray processes (plasma, flame, arc, high-velocity oxygen fuel) or materials at an accredited U.S. university,
- Have at least one year of studies remaining after this year,
- Be recommended by a supervisor/professor of the university they are attending (a professor must verify the student's financial need, and the student must also be recommended by at least one industrial source), and
- Present an essay about their interest in pursuing a career in thermal spray (maximum of three typed pages).

The application can be accessed at *aws.org/about/industry-partners/itsa/ITSA-Scholarship*. Winners will be announced in the fall.

Cold Spray Bridge Repair Concept Earns AISC Innovation Award

A University of Massachusetts (UMass) Amherst-led research team has received the 2026 "IDEAS | next Award" from the American Institute of Steel Construction (AISC) for developing a bridge repair method using cold spray additive manufacturing.

The process propels high-velocity metal powder onto damaged steel, building up layers that restore thickness and structural capacity. Unlike conventional repairs that often require welding, cutting, or replacing beams — and can disrupt traffic — the cold spray approach is designed to be faster and less intrusive.

Led by UMass Amherst Associate Professor Simos Gerasimidis, the team demonstrated the method in summer 2025 on a bridge in Great Barrington, Mass., marking the first known field application of cold spray on fixed bridge infrastructure. The project involved collaboration with UMass Amherst Associate Professor Chengbo Ai, as well as the Massachusetts Institute of Technology, the Massachusetts Department of Transportation, the Massachusetts Technology Collaborative, the U.S. Department of Transportation, and the Federal Highway Administration.

"This project demonstrated that cold spray additive manufacturing can move beyond the lab and into the field as a viable, rapid, and structurally meaningful repair strategy for steel bridges," said Gerasimidis in a UMass Amherst news release.

AISC recognized the work as an "idea that could change the future." According to AISC, the technique could expand options for localized steel repairs, including crack remediation and on-site modifications in hard-to-access areas.

Gerasimidis and Ai have also recently received additional support from the U.S. National Science Foundation and UMass Amherst's Institute of Applied Life Sciences.

Cold Spray Research Targets High-Temperature Aerospace Alloys

A NASA-funded collaboration involving the University of Utah's STARS Lab, Pennsylvania State University, and Elementum 3D is advancing cold spray additive manufacturing for high-temperature aerospace applications, including components made from NASA's GRX-810 alloy. The project, supported through NASA's Small Business Technology Transfer (STTR) Phase I program, focuses on improving how metal particles bond during high-velocity deposition — a key factor in producing durable components for extreme operating environments. These include rocket engine parts exposed to repeated thermal and mechanical stress.

Researchers are studying how processing conditions and particle behavior affect the performance of GRX-810, an alloy designed to withstand high temperatures and oxidative environments. Elementum 3D, Erie, Colo., is supplying the GRX-810 material while Penn State is developing the alloy's cold spray process. The University of Utah's STARS Lab is conducting single-particle testing using its laser-induced particle impact test (LIPIT) system. The results are expected to inform future spray-based manufacturing and repair strategies for propulsion systems.

TOCALO Co. Ltd. Signs Lease to Establish Coating Service Facility in Arizona

TOCALO Co. Ltd., a Japan-based global provider of advanced surface modification and coating technologies, has leased 32,045 sq ft of industrial space in Chandler, Ariz.

The new facility will support the company's expansion in the United States and strengthen its ability to serve semiconductor equipment manufacturers and other advanced semiconductor manufacturing customers. Chandler's innovation ecosystem, skilled workforce, and proximity to major transportation and technology corridors were key factors in the company's site selection decision.

"We found Chandler's environment and property to be perfectly aligned with our operational vision," said Yasuki Nakahira, vice president, global business development headquarters.

Behrman Capital Acquires Metallizing Service Co.

Behrman Capital, a private equity investment firm based in New York, has acquired Metallizing Service Co. Holdings (MSC), West Hartford, Conn. MSC provides highly engineered thermal spray coating and surface treatment solutions for critical engine components, utilizing advanced processes such as plasma spray and high-velocity oxygen fuel (HVOF). The company supports customers across commercial aerospace, military, industrial gas turbine, and business aviation platforms through a qualification-driven service model with NADCAP and AS9100 accreditations and in-house metallurgical capabilities.

MSC's management team, including Doug Chappel, vice president of business development — engineering and quality, and Charles Cavanagh, vice president of operations and administration, will continue to lead the company under Behrman's ownership.

Chappel commented, "This is an exciting milestone for Metallizing Service Company. Behrman Capital's experience building highly technical aerospace and defense companies makes them an excellent partner to assist the company and our experienced team with capturing significant growth opportunities on the horizon."

Integrated Global Services Buys Flamsprutarna AB

Integrated Global Services (IGS), Richmond, Va., has acquired Flamsprutarna AB, a Sweden-based global provider of turbine maintenance and thermal spray services. The acquisition strengthens IGS's ability to support power plant operators worldwide with integrated maintenance solutions across gas turbines, steam turbines, and nuclear assets.

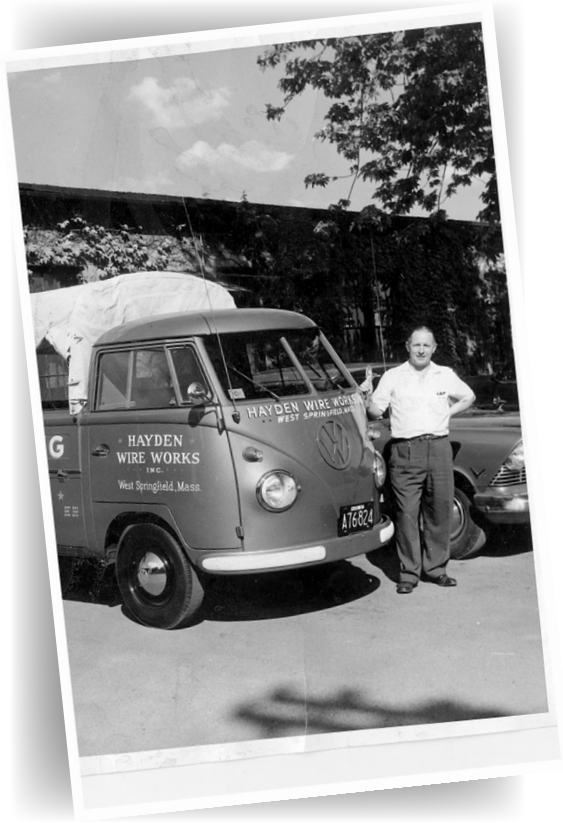
Flamsprutarna's expertise complements IGS's existing capabilities in large-frame gas turbine maintenance, enabling a more comprehensive, multitechnology service offering across combined-cycle and nuclear fleets. Flamsprutarna will continue to operate from its headquarters in Sweden, maintaining its existing team, technical expertise, and customer relationships. As part of IGS, the company is expected to expand its delivery capacity and support a greater volume of projects worldwide. Customers are expected to benefit from a more integrated, single-source service model; improved coordination across turbine technologies; and enhanced outage execution.

Rich Crawford, CEO of IGS, commented, "Power generators are under increasing pressure to deliver higher output with fewer outages and greater reliability. The addition of Flamsprutarna strengthens IGS's ability to support these requirements by expanding our capabilities in steam turbine and nuclear services while increasing our capacity to serve customers globally."

Flamsprutarna CEO Victor Aaroe-Holm (second from left) said, "Flamsprutarna has built a strong reputation for quality and safety in demanding operating environments. As part of IGS, we will be able to extend our reach and take on more projects globally while continuing to deliver the high standards our customers expect."

BY DANIEL C. HAYDEN

BEYOND THE BOOTH: A Practical Guide to Field Thermal Spraying



Charles Wesley "Wes" Hayden posing in front of a Hayden Wire Works' field services truck.

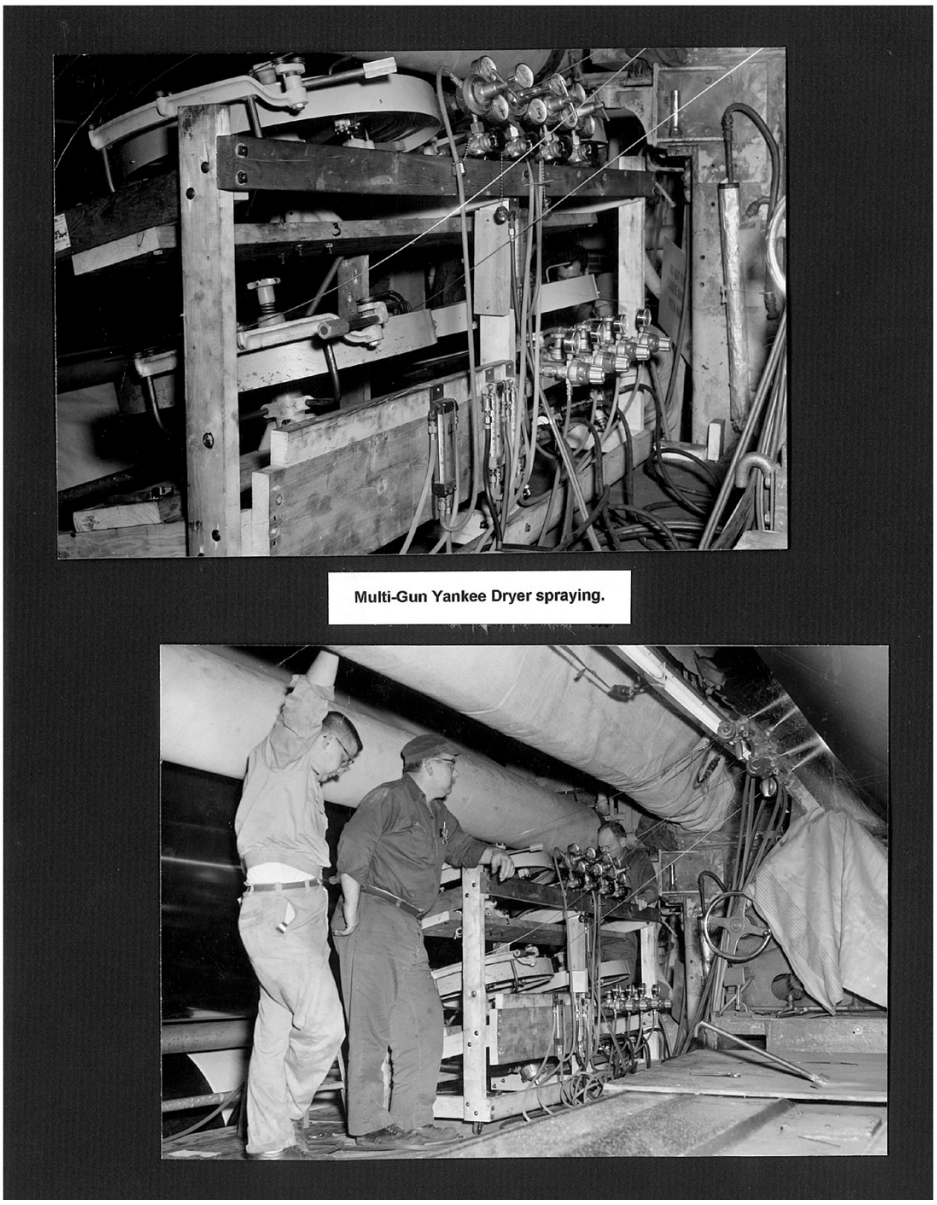
Thermal spraying in the field (outside the comfort of the job shop) is bread-and-butter work for many in our industry, including the coating of bridges and pipelines; the interiors of power plant boilers and hydroelectric waterways; and thousands of square feet of pipelines, refinery structures, and offshore rigs. For others — particularly those of us accustomed to spray booths and robots, jigs and fixtures, metallurgical lab coupons, and coordinate measure machine (CMM) inspections — the idea of doing what we do in a remote location is both intimidating and exhilarating. As part of ITSA's mission to grow and develop the thermal spray industry by sharing knowledge among its users, applicators, and vendors, this article intends to make the prospect of field work a little less scary and a little more accessible.

From the Industry's Roots to Today's Reality

Field-applied coatings have been an important part of our industry since its inception. Before spray booths and dust collectors were commonplace, Metco salesmen were out in machine shops, paper mills, and utility plants promoting the use of thermal spray technology to repair pump shafts and bearing fits, engine blocks and lathe beds. Any place metal had been lost due to wear or damage, thermal spraying was offered as a way to restore surfaces to good-as-new or better. The U.S. military embraced the technology and developed procedures and specifications to apply coatings for all kinds of repairs and enhancements, and wire spray guns and combustion powder setups found their way into shipyards, automobile repair shops, and millwright toolboxes all over the world.

The proliferation of spraying led hand in hand to the parallel proliferation of bad spraying, work done poorly without proper care and attention. As a result, many in our industry suffered under the reputation that thermal spray coatings would fail or "fall off." We entered a long period of rebuilding characterized by the development of newer, more robust spraying technologies, and tighter and better process controls and quality management practices, leading, eventually, to where many of us are today, with neat rows of spray cells and dust collectors, metallurgical labs, and clean rooms comfortably contained within our own buildings.

But it never changed the fact that our process is so very well suited to fixing things in the field, quickly and effectively, if done carefully and with good planning. Field work is a competency like any other, and field work performed well can do a great deal to get mission-critical machinery back online quickly and safely, provided the work is well organized, the limitations of working in the field are well understood, and both the customer and contractor reach an agreement about what constitutes a successful repair. This last element is especially important, and we will discuss it in detail later.



Flame wire spraying of a Yankee dryer in Pennsylvania for Hayden Wire Works.

Managing Risks Outside the Shop

First, why risk it? Thermal spray repairs in the field serve a unique purpose in modern manufacturing. After a machine failure, usually of a rotating element, the owner of the equipment faces steep losses in downtime and repair. If the machine's function is critical to a community, such as a power plant or water treatment facility, or if the value of lost productivity is significant, such as in a paper mill, automotive line, or food processing plant, every minute lost is a significant and expensive burden on the operator. If the equipment is too large to make spares reasonably available, conventional repairs might require disassembly, shipping, inspection, overhaul, return shipment, and reassembly. Each phase adds time and expense. Imagine if the repair isn't right the first time, and the job must be reworked. Each of those costs is doubled. If the repair could be done onsite, much of the delay and cost would be removed: less disassembly, less inconvenience, lower risk of shipping delays and issues, and the problems that do arise could be corrected right away.

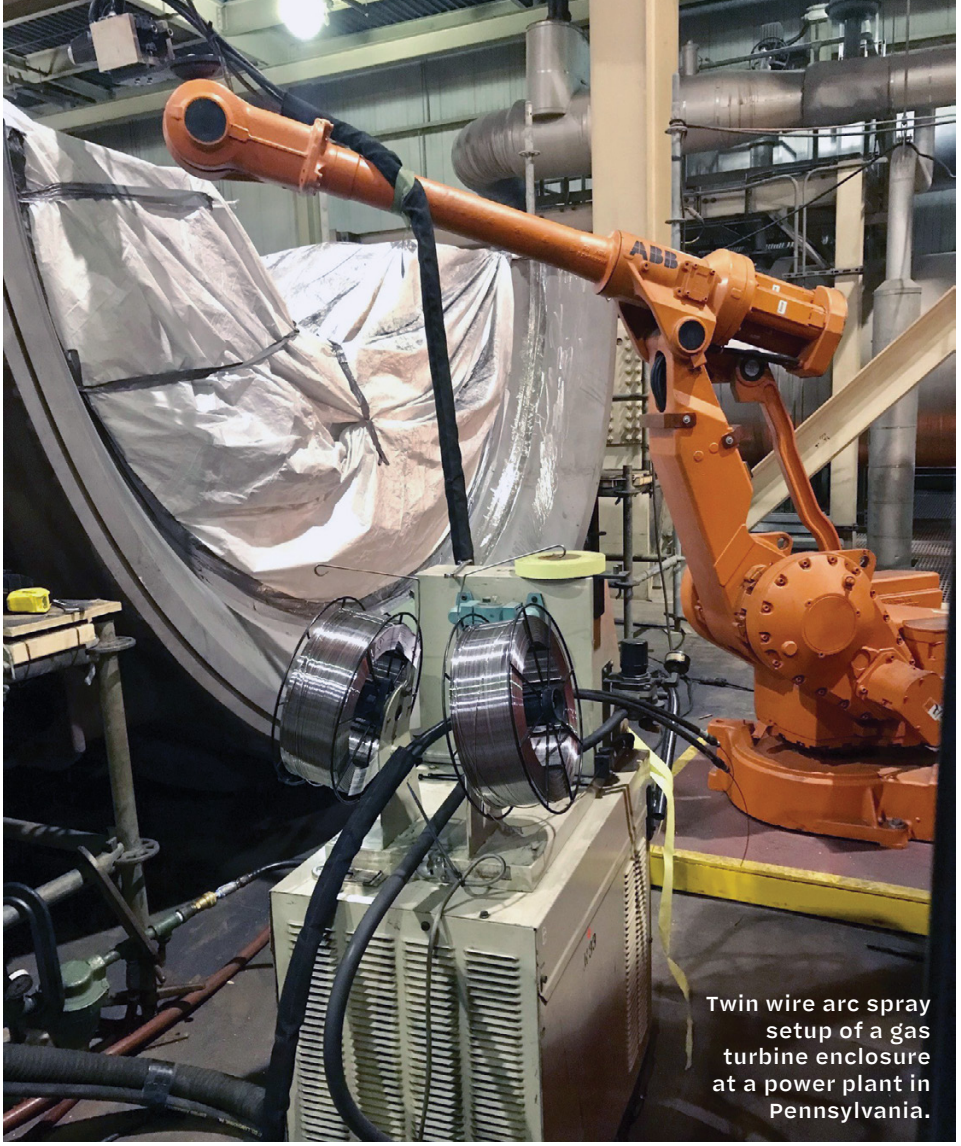
In the examples given earlier, power generation, water treatment, heavy or complex manufacturing, oil drilling and refining, the cost of downtime is significant, and the advantages of being able to restore operations quickly become apparent.

Entering this line of work has its challenges. Teams deployed to work in the field should have deep experience both in applying coatings and in understanding how they will perform. They must often work completely autonomously; if issues arise on the job, they must be able to manage them independently. These issues can be equipment related, such as a non-functioning powder feeder or a misbehaving blaster. They can be operational, such as inadequate compressed air supply or incorrect facility voltage. They can be engineering-oriented, such as inadequate access to the working area or an unreasonable expectation for dimensional tolerance or surface finish. Or, they can be political, such as battling with customer representatives about building access or job acceptance criteria. As with all things in manufacturing, good and talented people are at the core of any successful job.

Many of these risks can be relieved with thorough job planning. Broadly, job planning for a field project involves a set of categories: job scope, requirements, subcontracting, permitting, transportation, and completion. Comprehensive groundwork for these domains can alleviate (if not eliminate) the kinds of pitfalls described in the previous paragraph.

Setting the Foundation for Execution

Job scope is often the simplest part of the plan. It means



Twin wire arc spray setup of a gas turbine enclosure at a power plant in Pennsylvania.

identifying and agreeing with the customer on the materials to be used, which process(es) will be employed, any masking requirements, and the desired target dimensions, including surface finish. This bare-bones information is an essential part of any thermal spray estimate, but for field work, coming to an early agreement on these items will determine much of how the rest of the project planning and execution will go.

Once the scope is well defined and the customer and supplier are in agreement, the project requirements can be established: What is the ideal timeline required for the repair? Are there any applicable standards or specifications? What utilities and resources will the work require? Where will the work be done, and how much space is available for ancillary equipment and storage? What infrastructure is available for support (forklifts, cranes, scaffolding, shelter, exhaust, break room, restrooms etc.)? How accessible is the work zone (hours, escort requirements, availability of loading doors)? Much of this is cooperative in nature. Some things are fixed requirements of the work to be done and the equipment needed; others are finite resources of the customer's facility. Planning ensures that both parties have what they need to get the job done effectively and with minimal risk.

Coordinating Execution in the Field

Subcontracting is often necessary for field work if parts of the repair fall outside the core competencies of the customer or the spray contractor. For example, millwrights may be needed to disassemble and clean the work zone. Pre-machining and finish machining may be required. The work may necessitate the application of paints and sealers, and third-party inspection may be a contract requirement. Of course, it is preferable for the customer to arrange and negotiate as much of this as possible. They are more likely to have these kinds of resources already on hand or know what is available in their area. Still, some sites prefer a turnkey repair, where the spraying contractor is expected to handle all coordination.

State and local regulations may require special permitting for thermal spraying onsite. Environmentally sensitive areas may have air-quality limits or water-usage restrictions. Most large facilities have safety-training requirements for contractors working in their buildings. Issues such as fire watch, parking and loading-zone restrictions, and the use of cranes and forklifts by noncompany employees all come to bear. It is essential to know which of these requirements may apply in order to avoid an unplanned shutdown of the job when a local inspector or irritated safety officer happens to stop by to observe.

All field jobs require "shipping" of equipment and personnel from the home office to the job site. For mission-critical jobs, it is highly likely that the customer's planned outage window is tight and fixed, so contingency plans to ensure the field team and its tools arrive on time will be essential. In many cases, it is advisable to have both a primary and fallback plan for delivery so that an unexpected delay does not derail the project completely.

As mentioned earlier, agreement between the customer and the contractor on what constitutes job completion is

fundamental to the job plan before any physical work is done. Continuity between the quote request, quotation, and job router is important, but it is equally important that the customer and spray contractor agree about how job success will be measured and by whom. Coatings applied in the field will often need to be less precise than coatings applied in a shop, where high-accuracy machine tools can be used to prepare and finish the work. Very often, the goal in a field-applied coating is functional rather than visual appearance. The customer and contractor must agree on dimensions and tolerances. Whenever possible, verbiage should be included to ensure that the contractor's calibrated and traceable gauges are used for inspection rather than the customer's, which may be of unknown status or reliability. If job acceptance cannot be agreed upon, there is a high risk of excessive unplanned rework costs, delays, and resentment from both the customer, who wanted the job completed quickly, and the field team, which just wants to wrap up and go home.

Often, in a field job, there will be customer personnel onsite who may have opinions on how the job should be done or how it should look when finished, but if those personnel are not part of the contract acceptance process, their opinion fundamentally means little. Ultimately, the objective is to ensure that the contract requirements are met and that the stakeholders agree on the method used to determine this. For this reason, it can be useful to control who has access to the work zone. Plant personnel are often curious about our work because it is unusual and visually surprising. Extra people can be stressful for the coating team, especially if things are not going according to plan. Having at least one senior team member onsite who is experienced and comfortable advocating on behalf of the team is incredibly helpful when disputes with the customer arise.

Finally, project timeline milestones can be immensely valuable for ensuring that everyone connected to the project is aware of the progress. Establishing a plan for team and equipment departure from the shop, arrival onsite, unloading and staging, setup, blasting, spraying, cleanup, packing, departure, and return will keep everyone coordinated if issues arise and will give both the home office and the customer assurance that work is progressing as planned or not. There is tremendous value in keeping everyone in the loop and a great deal to lose if stakeholders are left in the dark. Likewise, once a repair is complete and the team has departed, staying in touch with the customer in the weeks and months that follow will ensure that the repair is performing as needed and solidify confidence that the spray shop stands behind its work.

Conclusion

Performing thermal spray work in remote locations presents many challenges, but it remains both an integral part of our industry's technical capability and an essential tool for getting mission-critical equipment back online quickly. Planning, redundancy, and skill are essential components for reliably delivering high-quality service in the field. Like any other capability, however, these essentials can be developed and strengthened. Hopefully, some of the common pitfalls outlined in this article can help remove the hesitation and fear that can come with taking thermal spray out of the shop and putting it on the road. Safe travels!

Laser cladding of a massive roll journal at a customer's facility in New Hampshire.

DANIEL C. HAYDEN *(daniel.hayden@haydencorp.com)* is president of Hayden Corp., West Springfield, Mass., chair of the AWS C2 Committee on Thermal Spray, and technical editor of *SPRAYTIME.*

BY ASHLEY HUNSAKER

HOW TO CHOOSE THE RIGHT COATING SUPPLIER: Key Factors to Consider

An employee confirms the coating microstructure.

Whether you work in welding, mining, or manufacturing, your equipment matters. You would never let an unskilled worker handle a rotary drill, so why would you expose your precious pump components to the wrong coating supplier?

While thermal spray coatings can be instrumental in extending the service life of your equipment and machine components, it is crucial to do your research before hiring a supplier. From regular quality checks to lab testing, the right thermal spray coatings supplier should tick all the boxes.

Are you wondering where to begin when picking the right supplier? Follow along to learn some important questions to consider when choosing your supplier.

1. Do they have standard written procedures?

Industrial components and mining equipment don't come cheap. While repairing corroded or worn-down parts is typically less costly than a full repair, entrusting your equipment to an unskilled supplier could spell trouble. A great way to get a baseline evaluation for a potential supplier is to inquire about their written standard procedure.

As a potential client, you should be privy to their standard procedures and processes. If a supplier or firm has established guidelines, it usually means they have considered the best order of operations and know how to handle your parts. These procedures should be readily available for you to check. Additionally, the vendor should offer the option of a shop visit or a quality audit. If you sense any hesitation or tension on the supplier's behalf, this may be a sign you should explore other options.

Lastly, be sure their standard operating procedures include processes for quality and coating inspections.

2. Do they participate in regular quality checks and lab testing?

Quality is key when it comes to thermal spray coatings. If you know that your potential supplier is already ISO 9001 certified, you can skip this question. However, if you are adamant about the consistency of your coatings, you should consider selecting a supplier that can undertake lab testing. Suppliers with an in-house testing lab can provide you with quick coating results and faster production turnaround times. Other questions you might want to ask include:

- How do these firms assess the quality of their services?
- Do they use the right instruments to measure coating thickness during the spray process?
- Do they have a coordinate-measuring machine to measure complex or spherical surfaces like valve balls?

An employee documents the final inspection.

3. Is their equipment regularly calibrated and maintained?

The best lab testing in the world won't mean much if your chosen supplier does not regularly calibrate or maintain their equipment. In some cases, the coating results you want may not even be achievable if the vendor is not regularly maintaining and monitoring their machines. Some sample questions to ask include the following:

- Is the vendor regularly checking their grinding wheels to ensure grit effectiveness?
- Do they have a preventative maintenance plan in place to mitigate errors from machine breakdowns?
- Are the pressures on their power feeder regularly checked?
- Do they regularly check their gun pressures and temperatures?
- Do they obtain material certifications for their wires and powders?

Remember, poorly maintained machinery can lead to longer processing times. It may be helpful to seek out a supplier that uses more modern, well-maintained machinery, such as robotic technology.

4. Do they follow EPA disposal guidelines?

While this factor may not directly affect your coating job, it's important to be aware of how your supplier disposes of hazardous materials. Certain materials used in thermal spray operations, such as chrome carbide powder and aluminum oxide grit, are hazardous substances and require special handling, storage, and disposal procedures. Understanding how your supplier disposes of these potentially dangerous materials will tell you a lot about their character and quality of work.

5. What is their company culture and level of commitment?

Thermal spray coatings may be applied to solve issues of corrosion, abrasion, and galling, but your thermal coatings supplier is more than just a one-stop shop. When selecting a supplier, you should assess the company culture, quality of work, and level of commitment. Working with a supplier who doesn't strive for perfection or value your time could leave you waiting on production delays, vague timelines, and inefficient communication.

Conclusion

While it may be tempting to simply opt for the supplier with the lowest price, sacrificing quality could leave you with inferior results.

Portions of this article were refreshed and published in a previous HTS Coatings blog post in 2021 titled, "5 Questions to Ask When Choosing a Thermal Spray Vendor."

ASHLEY HUNSAKER (*ahunsaker@htscoatings.com*) is CEO of HTS Coatings, Madison, Ill.

NOW ACCEPTING SCHOLARSHIP APPLICATIONS

Since 1991, ITSA has provided scholarship assistance to technologists and engineers who are pursuing a postgraduate degree in either Thermal Spray processes (Plasma, Flame, Arc, HVOF) or materials at an accredited university in the United States or Canada.

Up to three (3) scholarships

$2,000.00 each

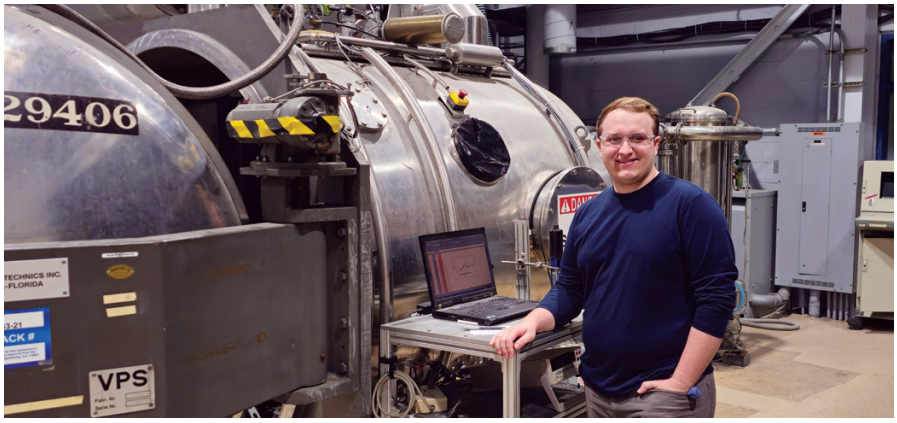
Application Deadline: August 21, 2026

For more eligibility information or to apply,
visit *thermalspray.org/scholarship*

BY CINDY WEIHL

ITSA SCHOLARSHIP WINNERS DRIVE THERMAL SPRAY INNOVATIONS

From advancing polymer-based cold spray technologies to improving the reliability of coating performance and testing, the 2025 ITSA Scholarship recipients represent the next generation of innovation in thermal spray. Each brings a unique perspective rooted in rigorous research, hands-on experience, and a commitment to real-world impact while sharing a common goal: pushing the boundaries of materials engineering and translating scientific discovery into durable, high-performance solutions across critical industries.



Antonio Colao

Antonio Colao's path into thermal spray began with curiosity and quickly turned into a clear sense of purpose. After completing his undergraduate degree in engineering science with a concentration in mechanical engineering at Stony Brook University, Stony Brook, N.Y., he chose to continue his studies there in materials science and engineering, immersing himself in research at the university's Center for Thermal Spray Research (CTSR).

It was at CTSR that Colao discovered the true scope and impact of thermal spray technology. Initially introduced to the lab by CTSR Director Dr. Sanjay Sampath, he recalled his first exposure as both overwhelming and compelling. Seeing a range of processes, from advanced coating systems to thermal-sprayed thermocouples and even legacy equipment that traced the field's evolution, offered a glimpse into what he described as the "limitless possibilities" of the discipline.

That impression deepened during his first Consortium for Thermal Spray Technology meeting, where conversations with industry professionals highlighted how relatively small coatings can deliver outsized gains in performance and durability. One example that stood out involved extending the life of mining equipment at a fraction of replacement cost, an experience that cemented his understanding of thermal spray as a powerful, real-world engineering solution.

"What continues to interest me is how these relatively modest coatings can have such a large impact on a component's performance and longevity," Colao said. At the same time, he points to the field's process-sensitive nature as both its greatest challenge

and opportunity. "It opens the door to constant problem solving."

Colao's research reflects that mindset. His graduate work focuses on the repeatability of tensile adhesion testing (TAT), a critical issue in evaluating coating performance. By systematically studying variables such as processing conditions, adhesive systems, and failure modes, he aims to better understand sources of variability and improve the reliability of testing methods. His work has included testing ceramic coatings such as yttria-stabilized zirconia and titania across different substrates and processes, supported by detailed data analysis and statistical evaluation.

In parallel, he has explored other applications, including embedded thermal-sprayed thermocouples used to measure temperature gradients within thermal barrier coatings under plasma exposure. Together, these experiences have given him a broad, hands-on perspective on both the science and application of thermal spray systems.

Since receiving the ITSA Scholarship, Colao's trajectory has continued to accelerate. He described the award as both an honor and validation of his direction. "It reinforced my commitment and showed me how valuable academic research is to the industrial community," he said. The support and confidence have enabled him to deepen his research and engagement within the field.

One milestone came when he returned to the Consortium for Thermal Spray Technology meeting not as a newcomer, but as a presenter. Selected to share his findings on adhesion-testing variability, he noted the contrast of feeling overwhelmed at his first meeting to confidently presenting research just months later.

Beyond academia, Colao has also gained industry experience through an internship with ReliaCoat Technologies, where he plans to continue contributing as his studies progress. The role has strengthened his understanding of real-world applications and sharpened his interest in coating metrology, standards development, and measurement techniques — areas he sees as central to the field's future.

Looking ahead, Colao envisions a career rooted in advancing thermal spray through both technical rigor and applied problem-solving. Whether in industry or collaborative research settings, he hopes to work on projects that improve coating reliability, refine testing standards, and bridge the gap between laboratory research and industrial practice.

For students considering the field, his advice reflects his own experience: progress comes through consistency. "Every day you spend learning adds real value," he explained. "Those small gains compound over time." While the early stages can feel overwhelming, he emphasized the importance of patience, curiosity, and trusting the long-term process.

With a growing body of research, hands-on experience, and a clear focus on practical impact, Colao is building a career that reflects the core strengths of thermal spray itself — precision, resilience, and the ability to deliver lasting performance in demanding environments.

Suleiman Muktari

From the start of his academic journey, Suleiman Muktari has been driven by a fascination with how materials behave under extreme conditions — how they endure heat, radiation, stress, and, ultimately, how they fail. That curiosity now defines his work as a third-year PhD student in mechanical and materials engineering at Florida International University, Miami, Fla., where his research sits at the intersection of materials science, surface engineering, and sustainability.

Muktari focuses on cold spray additive manufacturing of polymer-based composite coatings, an emerging and rapidly evolving area within the thermal spray field. What draws him to thermal spray is its ability to transform materials science into real engineering solutions by designing surfaces capable of withstanding harsh service environments across applications such as aerospace propulsion, marine corrosion protection, and radiation-intensive systems.

Unlike traditional thermal spray processes, cold spray relies on the kinetic energy of high-velocity particles rather than heat, making it especially promising for polymers, which are often vulnerable to thermal degradation. Muktari is particularly interested in pushing this technology beyond its conventional metallic applications to create lightweight, high-performance polymer composite coatings with enhanced mechanical strength, thermal stability, and multifunctionality.

"The challenge," he noted, "is that polymer cold spray is still an emerging science." Polymers behave very differently under high-velocity impact, with bonding mechanisms highly sen-

sitive to temperature, particle velocity, surface conditions, and molecular structure. Understanding these relationships requires a combination of experimental work, thermal analysis, and modeling — complexities that Muktari sees not as obstacles, but as motivation.

His research aims to establish fundamental process-structure-property relationships for these materials. Recent work has focused on thermodynamics and crystallization kinetics, examining how cold spray processing influences molecular ordering and crystallinity — key factors in determining the strength and long-term performance of polymer coatings. He is also investigating particle bonding and deformation mechanisms in composite systems, helping define how advanced coatings can be engineered for demanding structural and protective applications.

That work has already yielded promising results, including coatings with high deposition efficiency, improved hardness, and enhanced crystallinity. Just as importantly, it is helping position polymer composite cold spray as a viable pathway for next-generation lightweight materials solutions.

Recognition from ITSA has reinforced that trajectory. Muktari describes receiving the ITSA Scholarship as both an honor and a turning point. "It was more than financial support," he said. "It was a signal that the community sees value in this direction of research." The award has strengthened his confidence, expanded his professional network, and supported his ability to share his work through publications and conferences.

Beyond the lab, Muktari is actively engaged in the broader materials community. Through his involvement with the ASTM student chapter, he has participated in standards discussions and interdisciplinary initiatives that connect academic research with industrial practice. His selection to the ASTM International Emerging Professionals Program in 2025 further deepened his understanding of how research transitions into real-world applications through collaboration and standards development.

Looking ahead, Muktari plans to build a career that bridges research, innovation, and application. Whether in industry, national laboratories, or academia, he is particularly interested in roles that translate laboratory-scale discoveries into practical engineering solutions across sectors such as aerospace, automotive, marine systems, and energy. Long term, he hopes to lead a research program focused on advanced manufacturing, multifunctional materials, and sustainable coating technologies while also mentoring future engineers.

For students considering the field, his advice is straightforward: be curious and patient. Thermal spray, he emphasized, is more than a coating process; it is a platform for solving complex, real-world problems. "The key is to build strong fundamentals and understand how processing connects to performance," he shared. "That's where the real value lies."

Muktari's work is guided by a clear vision: expanding the possibilities of cold spray technology and developing materials that not only withstand extreme environments but also help create more efficient, durable, and sustainable engineering systems.

Apply Now for 2026 Scholarships

ITSA awarded three scholarships in 2025. Emmanuel Aikulola from North Carolina State University, Raleigh, N.C., was the third recipient.

To learn more about ITSA scholarships and apply for the 2026 awards, see page 15 of this issue and visit *thermalspray.org*.

CINDY WEIHL *(cweihl@aws.org)* is editor-in-chief of *SPRAYTIME*.

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Thermal Spray Coatings Market Expands as Industrial Demand for Surface Protection Accelerates through 2033

Global Thermal Spray Coatings Market Size, Share, Growth Analysis, By Product Type (Metal, Ceramics, Intermetallic, Polymers, Carbides, Abradable, Others), By Process/Technology (Combustion Flame, Electric Energy, Others), By Function, By End User, By Region - Industry Forecast 2026–2033 indicates strong growth in the global thermal spray coatings market, driven by increasing demand from aerospace, automotive, energy, healthcare, and industrial sectors. The market was valued at $11.77 billion in 2024 and is projected to grow from $12.37 billion in 2025 to $18.42 billion by 2033, representing a compound annual growth rate of 5.1% during the forecast period. The report cites growing demand for longer equipment lifespan, reduced maintenance costs, and higher operational efficiency as key factors accelerating adoption worldwide. Additional growth drivers include expanding use across aerospace, automotive, and power generation markets, along with rising interest in environmentally friendly surface treatment alternatives and medical device applications. Emerging trends identified in the release include the integration of artificial intelligence into coating processes for improved precision and productivity, stronger demand for aftermarket repair and refurbishment services, increased use of ceramic and carbide coatings for high-temperature environments, wider adoption of sustainable coating technologies, and expansion into advanced industrial and healthcare applications. The study also notes challenges facing the market, including high upfront equipment costs, shortages of skilled labor for specialized coating processes, and technical complexity that can create application risks.

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Cold Spray AM Equipment Market Gains Momentum with Rising Industrial Demand through 2032

Global Cold Spray Additive Manufacturing Equipment Market Insights — Industry Share, Sales Projections, and Demand Outlook 2026–2032 highlights strong growth potential in the global cold spray additive manufacturing (AM) equipment market, driven by expanding aerospace, automotive, and medical applications. The market was valued at approximately $73.4 million in 2025 and is projected to reach $121 million by 2032, reflecting a compound annual growth rate of 7.5% from 2026 to 2032. The report is designed to support business decision-making through detailed analysis of historical performance, future scenarios, market dynamics, key segments, and regional demand trends. It also examines production volumes, revenue potential, competition, and strategic growth opportunities. The study notes that the market is highly competitive, with manufacturers focused on innovation, expansion strategies, partnerships, mergers and acquisitions, and increased investment in research and development. Market segmentation includes both high-pressure and low-pressure cold spray systems, with major end-use applications spanning aerospace, automotive, medical, and other industrial sectors. The report also emphasizes broader trends such as digitization, automation, sustainable materials, and emerging niche applications expected to shape the future of the cold spray AM equipment industry.

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Thermal Barrier Coatings Market Poised for Steady Growth as High-Temperature Protection Demand Rises through 2033

Thermal Barrier Coatings Market: Industry Trends, Share, Size, Growth, Opportunity, and Forecast 2026–2033 projects continued expansion in the global thermal barrier coatings market, driven by increasing demand across aerospace, power generation, automotive, and industrial sectors. The market is estimated at $18.78 billion in 2025 and is expected to reach $27.16 billion by 2032, growing at a compound annual growth rate of 5.4%. The report includes more than 134 figures, tables, and charts designed to support business planning and investment decisions. According to the release, companies in the market are actively pursuing strategies such as new product launches, collaborations, expansions, joint ventures, and commercial agreements to strengthen share and maintain leadership positions in regional markets. The report also emphasizes the impact of technological advancements, evolving regulations, supply chain conditions, and emerging product opportunities expected to shape the market through 2033. Furthermore, the study provides a forward-looking perspective on various factors that are expected to boost the market's overall growth.

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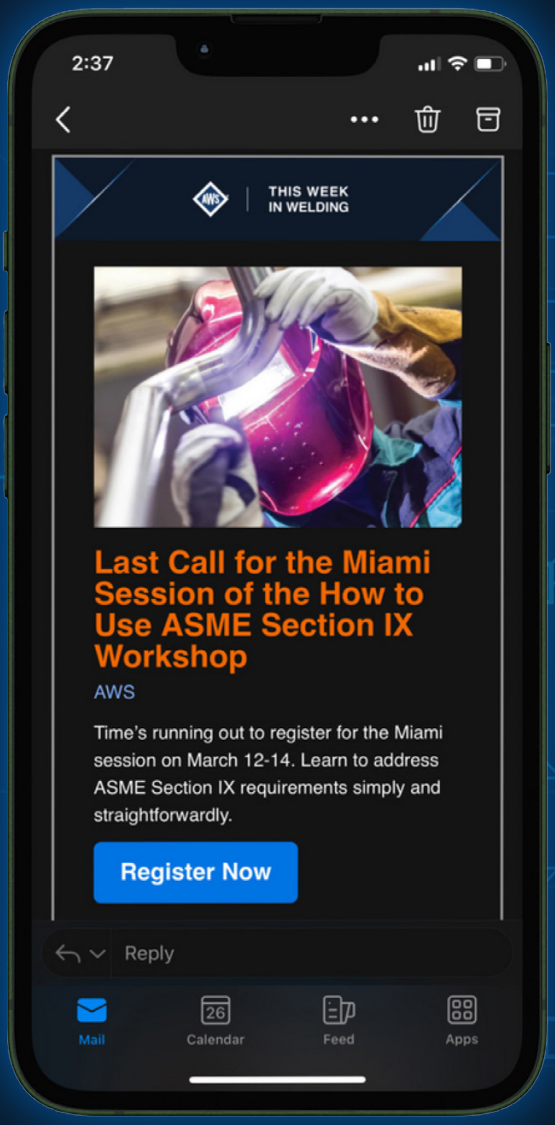

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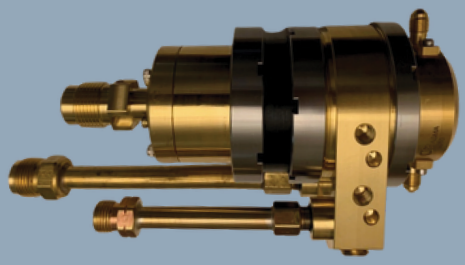

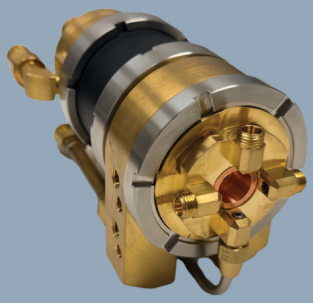

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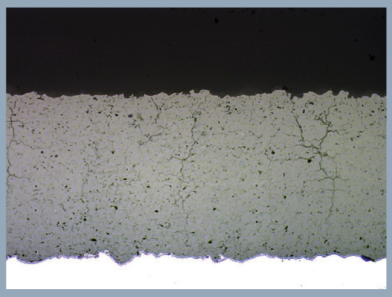

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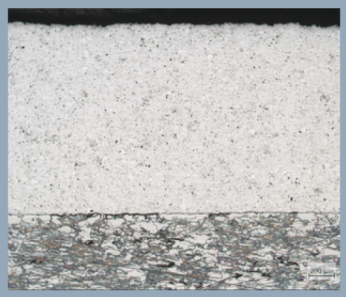

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